# PATENT ABSTRACTS OF JAPAN

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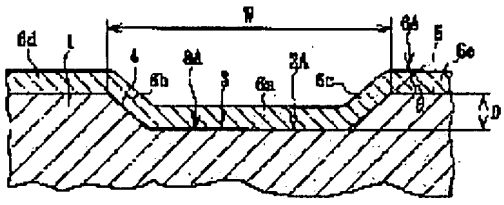
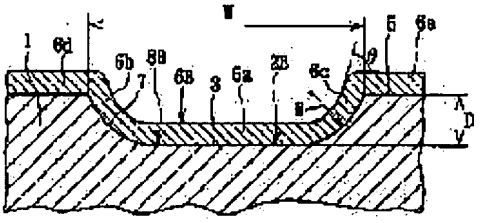
## (54) PRODUCTION OF BULKY BODY BY CHEMICAL VAPOR PHASE GROWING METHOD





(57)Abstract:
PROBLEM TO BE SOLVED: To prevent the generation of cracks over a large area by providing a vase material with recessed parts recessed form the surface, forming thick films of ceramics or the like on the exposed faces facing the recessed parts by vapor growing and removing the base material from the thick films.
SOLUTION: The surface of a base material 1 composed of graphite or the like is provided with recessed parts 2A and 2B. The exposed faces preferably contain a slope with the angle of $\theta$=30° or larger, particularly about ≥60° to the surface of the base material, in the case curved face are formed, ≥0.5 mm radius of curvature R is preferable, the maximum width W of the recessed parts 2A and 2B shown from the planar face is preferably controlled to ≥50 mm, and the depth D of the recessed parts is suitably controlled to about 1 to 10 mm. On the exposed faces facing to the recessed parts 2A and 2B in this base material 1, thick films 6A and 6B of silicon carbide or the like are formed to the thickness of ≥1 mm by a chemical vapor deposition

method. After that, form this thick films 6A and 6B, the base material 1 is removed by cutting, grinding, baking or the like to obtain a bulky body composed of the thick films 6A and 6B and free from cracks.

## CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the bulk object by chemical vapor deposition characterized by to acquire said bulk object from the thick film which is the approach of manufacturing the bulk object which consists of said thick film by removing said base material from said thick film after forming a thick film in a base material by chemical vapor deposition, prepared the crevice dented from the front face in said base material, formed the thick film by chemical vapor deposition on the exposure which faces said crevice of said base material, and was formed on said exposure.
[Claim 2] The manufacture approach of the bulk object by chemical vapor deposition according to claim 1 characterized by for the maximum width when seeing said crevice superficially being 50mm or more, and the thickness of said thick film formed on said exposure being 1mm or more.
[Claim 3] The manufacture approach of the bulk object by chemical vapor deposition according to claim 1 or 2 characterized by said exposure of said crevice containing the part which makes the include angle of 30 degrees or more to said front face of said base material when said base material is seen to said front face in a perpendicular cross section.
[Claim 4] The manufacture approach of the bulk object by chemical vapor deposition given in any one claim of claim 1-3 characterized by including the part whose radius of curvature of said exposure of said crevice is 0.5mm or more when said base material is seen to said front face in a perpendicular cross section..
[Claim 5] The manufacture approach of the bulk object by chemical vapor deposition given in any one claim of claim 1-4 characterized by for said thick film consisting of silicon carbide, and said base material consisting of a graphite.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach of manufacturing the bulk object which consists of a thick film, by removing a base material from a thick film, after forming a thick film in a base material by chemical vapor deposition.
[0002]
[Description of the Prior Art] Chemical vapor deposition is used abundantly in order to form various kinds of ceramic thin films on a base material. However, if a machining allowance is taken into consideration when a thick film tends to be formed on a base material, a base material tends to be removed from this thick film and it is going to acquire a bulk object by chemical vapor deposition, the thickness of the thick film before removing a base material needs to be usually 1mm or more.
[0003]
[Problem(s) to be Solved by the Invention] However, when this invention person formed

the silicon carbide thick film in the front face of for example, a graphite base material by chemical vapor deposition, it was easy to generate a crack in a thick film. When especially thickness of a thick film was set to 1mm or more and the maximum width of a thick film was set to 50mm or more, it was difficult to form membranes, without generating a crack in a thick film, and it was required to control membrane formation conditions strictly to satisfy usually very narrow membrane formation conditions. Especially the thing for which the crack generated in the front-face side of a thick film is prevented covering a large area was very difficult.

[0004] The technical problem of this invention is preventing generating of the crack in the bulk inside of the body on the occasion of manufacturing the bulk object which consists of a thick film by removing a base material from a thick film, after forming a thick film in a base material by chemical vapor deposition.

[0005]

[Means for Solving the Problem] This invention is the approach of manufacturing the bulk object which consists of a thick film by removing a base material from a thick film after forming a thick film in a base material by chemical vapor deposition, and is characterized by acquiring a bulk object from the thick film which prepared the crevice dented from the front face in the base material, formed the thick film by chemical vapor deposition on the exposure which faces the crevice of a base material, and was formed on the exposure.

[0006] As a result of this invention person's inquiring about the cause of a thick film which a crack generates especially in a front-face side, in the case of the thin film, in the case of the thick film, great tensile stress which is not produced found out acting on the front-face side. It is thought that there is probably an inclination to grow up in the direction which a crystal leaves mutually on the front face of a thick film, in the case of a thick film since the distance of the crystal growth from a base material to the front face of a thick film becomes large.

[0007] this invention person established the crevice in the base material based on this knowledge, and after he formed the thick film by chemical vapor deposition on the exposure which faces this crevice among base materials, he hit on an idea of cutting down a thick film. By this, compressive stress comes to be added on the surface of a thick film on the exposure of a crevice among thick films. Generally, the pressure resistance of the compressive stress to the tensile stress of the ceramics is called about ten times from several times. Thereby, when it was usual, whether a metaphor is the case where a thick film with a thickness of 1mm or more is formed covering the maximum width of 50mm or more or was the case where membranes were formed on the membrane formation conditions which require tensile stress for a thick film, it succeeded in preventing generating of the crack within a thick film.

[0008] Drawing 1 (a) and (b) are the typical sectional views for explaining each operation gestalt of this invention.

[0009] In drawing 1 (a), crevice 2A dented from the front face 5 in the base material 1 is prepared. Exposure 8A to crevice 2A of a base material 1 consists of a flat inclined plane 4 substantially prepared between the flat base 3, and a base 3 and a front face 5. By chemical vapor deposition, thick-film 6A is formed on the front face 5 of a base material, and exposure 8A. Thick-film 6A consists of parts for parts for base up part 6a and the side-face upper part 6b and 6c, and the surface upper part 6d and 6e.

[0010] In drawing 1 (b), exposure 8B to crevice 2B of a base material 1 consists of an inclined plane 7 substantially prepared between the flat base 3, and a base 3 and a front face 5. The inclined plane 7 is making the approximate circle arc. By chemical vapor deposition, thick-film 6B is formed on the front face 5 of a base material, and exposure 8B. Thick-film 6B consists of parts for parts for base up part 6a and the side-face upper part 6b and 6c, and the surface upper part 6d and 6e. In addition, the mask of the front face 5 is carried out, and a thick film can be prevented from generating in drawing 1 (a) and (b).
[0011] Cutting, grinding, or baking removes a base material 1, and the bulk object which consists of thick films 6A and 6B is acquired. By parts for base up part 6a and the side-face upper part 6b and 6c, and the surface upper part, under the present circumstances, 6d, It can be used as a bulk object, without separating 6e, and parts for the surface upper part 6d and 6e can be separated from parts for base up part 6a and the side-face upper part 6b and 6c, or parts for base up part 6a and the side-face upper part 6b and 6c can be separated, respectively, and the bulk object of another object can also be acquired.
[0012] In crevice 2A of a gestalt like drawing 1 (a), when a base material 1 is seen to a front face 5 in a perpendicular cross section, as for the include angle theta to the front face 5 of the side face 4 of exposure 8A, it is desirable that it is 30 degrees or more from a viewpoint of applying compressive stress to a thick film certainly, and it is still more desirable that it is 60 degrees or more. Moreover, it is desirable to make theta into 120 degrees or less from a viewpoint of preventing distortion and a crack, and considering as 100 degrees or less is still more desirable. [ / near the interface of a thick film and a base material ]
[0013] Furthermore, since there is an inclination for theta to collect on the corner of the base 3 of a crevice and a side face 4 at the time of chemical vapor growth in being large, and for material gas to produce a minute cavity, it is desirable to make theta into 110 degrees or less from a viewpoint of preventing such a cavity.
[0014] Also in crevice 2B of a gestalt like drawing 1 (b), when a base material 1 is seen to a front face 5 in a perpendicular cross section, about the optimum range of the include angle theta to the front face 5 of the inclined plane (side face) 7 of exposure 8B, the above-mentioned convention is applied. That is, it is thought that the compressive stress which joins a thick film receives control mainly with the magnitude of theta.
[0015] R shows radius of curvature when the inclined plane 7 is curving. In being small, the inclined plane 7 is curving [ R ] steeply, and in being large, the inclined plane 7 is curving [ R ] gently. If R becomes infinity, it will become the gestalt of drawing 1 (a).
[0016] And when a base material 1 is seen to a front face 5 in a perpendicular cross section, as for exposure 8B, it is desirable that the part with a radius of curvature of R= 0.5mm or more is included, and it is still more desirable that the part 3.0mm or more is included. Furthermore, it is desirable that the whole exposure 8B consists of a part with a radius of curvature of R= 0.5mm or more (3.0 moremm or more), and does not contain a less than (less than 3.0 moremm) 0.5mm part in this case. Radius of curvature R tends to produce defects of gas accumulation in a less than 0.5mm part at the time of chemical vapor growth, supply of fresh gas is checked locally, and there is an inclination which a cavity produces.
[0017] On the other hand, in drawing 1 (a), 90 to 120 ", when large in comparison, as theta mentioned above, in the corner of a base 3 and an inclined plane 4, it becomes easy

to produce defects of gas accumulation. It is desirable to set R to 0.5mm or more from a viewpoint of preventing such defects of gas accumulation.
[0018] If the thickness of a thick film is the thickness which can form membranes by chemical vapor deposition, there will be especially no upper limit.
[0019] Although especially an upper limit does not have the maximum width W of a crevice, if the maximum width W of a crevice becomes too much large, it will become easy to generate a crack in a thick film in the base of the crevice again. In this case, it is desirable to set the maximum width W of a crevice to 500mm or less. However, when becoming easy to generate a crack in the thick film with which the maximum width W of a crevice was formed on the exposure to the crevice of a base material since it was large, the second crevice can be further formed in the base of the crevice.
[0020] Depth D of a crevice can be suitably set up according to the configuration of the bulk object made into the purpose. However, it is desirable to set D to 1mm or more from a viewpoint of the operation effectiveness by this invention. Moreover, it is desirable to set D to 10mm or less from a viewpoint of preventing the nonuniformity of the thickness of the thick film on an exposure.
[0021] As ceramics which constitutes a bulk object, silicon carbide, boron carbide, titanium carbide, silicon nitride, alumimium nitride, boron nitride, a silica, an alumina, a zirconia, a titania, lanthanum chromite, lanthanum KOBARU tightness, and a lanthanum comics night are desirable, and silicon carbide is the most desirable.
[0022] Especially preferably, the purity of the ceramics in a thick film is 99.9999% or more, and relative density is seen to 0.1% of order, and is the same completeness precise object as theoretical density.
[0023] Although especially the quality of the material of a base material is not limited, especially its following are desirable.
(1) The sintered compact which uses silicon carbide as a principal component. For example, the sintered compact whose relative density the presentation ratio of (a) silicon carbide is 90% or more, and is 90% or more. (b) The porosity sintered compact whose relative density the presentation ratio of silicon carbide is 90% or more, and is 56% - 90%.
(2) The mixed sintered compact of silicon carbide and metal silicon.
(3) Insulating ceramics, such as silicon nitride and alumimium nitride.
(4) Graphite.
[0024] In itself [ chemical-vapor-deposition ], it can usually carry out by law. However, this invention is especially suitable in the field where membrane formation temperature is high in comparison, i.e., the field where a membrane formation rate is high in comparison. Especially in the field where membrane formation temperature is high in comparison, i.e., the field where a membrane formation rate is high in comparison, it is because it is easy to generate tensile stress in the front-face side of a thick film.
[0025] Since such temperature conditions change according to the class of ceramics which constitutes a thick film, they are difficult for becoming common as a numeric value. However, generally, when the membrane formation thickness per hour is 0.08mm or more, especially this invention is suitable.
[0026] Since it described above when the thick film of silicon carbide was formed, this invention is suitable especially when membrane formation temperature is 1370 to 1500 degree C.

[0027] The bulk object of the ceramics manufactured by this invention is applicable to various kinds of products. As such a product, the combustor for gas turbines, a stationary blade, a bucket, a heat exchanger, and combustion gas path components can be illustrated. Moreover, it is applicable also to an electromagnetic wave transparency object. In this, the dome for generating the tube for generating an electromagnetic wave transparency aperture, RF electrode equipment, and the high frequency plasma and the high frequency plasma can be illustrated. Moreover, the bulk object manufactured by this invention can be used as a base material of the susceptor for installing a semi-conductor wafer. As such a susceptor, a ceramic electrostatic chuck, a ceramic heater, and a RF arrangement of electrode can be illustrated. In addition, it can be used as a base material for each equipments for semi-conductor manufacture, such as a lift pin for supporting a dummy wafer, a shadow ring, and a semi-conductor wafer, and a shower plate.
[0028]
[Example] ((A) Experiment) According to said approach explained referring to drawing 1 (a), the bulk object which consists of silicon carbide was acquired. The silicon carbide film was formed in the front face of the graphite base material 1 by chemical vapor deposition. The configuration of a base material was a monotonous configuration, the dimensions of the front face 5 of a base material and a tooth back (not shown) are 600mm long and 50mm wide, and thickness of a base material was set to 20mm. Five was ground with the**800 or more front faces [ of a base material ] grinding stone, and the center line average surface roughness Ra was set to less than 3 micrometers. Crevice 2A was formed in the front-face 5 side of a base material. The flat-surface configuration of crevice 2A was made into the rectangle. The dimension of crevice 2A was changed as shown in drawing 1 . However, the crevice is not established in the front face of some base materials.
[0029] The base material 1 was held and installed in the chemical vapor growth furnace. Under the present circumstances, the base material was installed so that the front face 5 and tooth back of a base material 1 might become parallel to the jet direction of reactant gas, namely, so that the side face (not shown) of the base material of a monotonous configuration might counter an exhaust nozzle.
[0030] Vacuum suction of the inside of a furnace was carried out, argon gas permuted and the temperature up was carried out to 1400 degrees C. Subsequently, an argon and hydrogen are used as carrier gas and it is SiCl4 as reactant gas. And CH4 It introduced. The ratio of Si to C was adjusted to Si/C=1.1-1.3 (rate of a volume ratio when converting into reference condition). Furnace internal pressure was adjusted to 100-300Torr. Membrane formation of 30 to 50 hours was performed, it cooled, and the thick film of the silicon carbide of three to 5 mm thickness was obtained. Each obtained thick film was cut, the cross section was ground, and the existence of a crack was observed with the optical microscope. A result is shown in Table 1.
[0031]
[Table 1]

| | 凹部の縦横長さ（mm） | 凹部の最大幅W（mm） | 凹部の深さD（mm） | θ（°） | クラック等の観察結果 |
|---|---|---|---|---|---|
| 実験A1 | なし | なし | なし | なし | クラック発生 |
| 実験A2 | 40 | 50 | 6 | 20 | クラック発生 |
| 実験A3 | 40 | 50 | 6 | 30 | クラックなし |
| 実験A4 | 40 | 500 | 10 | 20 | クラック発生 |
| 実験A5 | 40 | 500 | 10 | 90 | クラックなし |

[0032] In experiment A5, although the crack was not seen, the minute cavity had produced it in the corner of the base of a crevice.

[0033] ((B) Experiment) The thick film of silicon carbide was produced like Experiment A. However, crevice 2B of the configuration shown in drawing 2 (b) was formed. The flat-surface configuration of crevice 2B was made into the square, and the dimension was changed as shown in Table 2. Membrane formation of 30 to 50 hours was performed, it cooled, and the thick film of the silicon carbide of three to 5 mm thickness was obtained. Each obtained thick film was cut, the cross section was ground, and the existence of the cavity in the corner of the base 3 of crevice 2B was observed with the optical microscope. A result is shown in Table 2.

[0034]

[Table 2]

| | 凹部の縦横長さ（mm） | 凹部の最大幅W（mm） | 凹部の深さD（mm） | θ（°） | 曲率半径R（mm） | 空洞の有無 |
|---|---|---|---|---|---|---|
| 実験B1 | 10 | 50 | 6 | 90 | 0.2 | 空洞あり |
| 実験B2 | 40 | 50 | 6 | 90 | 0.5 | 空洞なし |
| 実験B3 | 10 | 500 | 10 | 90 | 0.2 | 空洞あり |
| 実験B4 | 40 | 500 | 10 | 90 | 3.0 | 空洞なし |

[0035]

[Effect of the Invention] As stated above, after forming a thick film in a base material by chemical vapor deposition, according to this invention, on the occasion of manufacturing the bulk object which consists of a thick film, generating of the crack in the bulk inside of the body can be prevented by removing a base material from a thick film.

## TECHNICAL FIELD

[Field of the Invention] This invention relates to the approach of manufacturing the bulk object which consists of a thick film, by removing a base material from a thick film, after forming a thick film in a base material by chemical vapor deposition.

## PRIOR ART

[Description of the Prior Art] Chemical vapor deposition is used abundantly in order to form various kinds of ceramic thin films on a base material. However, if a machining allowance is taken into consideration when a thick film tends to be formed on a base material, a base material tends to be removed from this thick film and it is going to acquire a bulk object by chemical vapor deposition, the thickness of the thick film before removing a base material needs to be usually 1mm or more.

## EFFECT OF THE INVENTION

[Effect of the Invention] As stated above, after forming a thick film in a base material by chemical vapor deposition, according to this invention, on the occasion of manufacturing the bulk object which consists of a thick film, generating of the crack in the bulk inside of the body can be prevented by removing a base material from a thick film.

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when this invention person formed the silicon carbide thick film in the front face of for example, a graphite base material by chemical vapor deposition, it was easy to generate a crack in a thick film. When especially thickness of a thick film was set to 1mm or more and the maximum width of a thick film was set to 50mm or more, it was difficult to form membranes, without generating a crack in a thick film, and it was required to control membrane formation conditions strictly to satisfy usually very narrow membrane formation conditions. Especially the thing for which the crack generated in the front-face side of a thick film is prevented covering a large area was very difficult.

[0004] The technical problem of this invention is preventing generating of the crack in the bulk inside of the body on the occasion of manufacturing the bulk object which consists of a thick film by removing a base material from a thick film, after forming a thick film in a base material by chemical vapor deposition.

## MEANS

[Means for Solving the Problem] This invention is the approach of manufacturing the bulk object which consists of a thick film by removing a base material from a thick film after forming a thick film in a base material by chemical vapor deposition, and is characterized by acquiring a bulk object from the thick film which prepared the crevice dented from the front face in the base material, formed the thick film by chemical vapor deposition on the exposure which faces the crevice of a base material, and was formed on the exposure.

[0006] As a result of this invention person's inquiring about the cause of a thick film which a crack generates especially in a front-face side, in the case of the thin film, in the case of the thick film, great tensile stress which is not produced found out acting on the front-face side. It is thought that there is probably an inclination to grow up in the direction which a crystal leaves mutually on the front face of a thick film, in the case of a thick film since the distance of the crystal growth from a base material to the front face of a thick film becomes large.

[0007] this invention person established the crevice in the base material based on this knowledge, and after he formed the thick film by chemical vapor deposition on the exposure which faces this crevice among base materials, he hit on an idea of cutting down a thick film. By this, compressive stress comes to be added on the surface of a thick film on the exposure of a crevice among thick films. Generally, the pressure resistance of the compressive stress to the tensile stress of the ceramics is called about ten times from several times. Thereby, when it was usual, whether a metaphor is the case where a thick film with a thickness of 1mm or more is formed covering the maximum width of 50mm or more or was the case where membranes were formed on the membrane formation conditions which require tensile stress for a thick film, it succeeded in preventing generating of the crack within a thick film.

[0008] Drawing 1 (a) and (b) are the typical sectional views for explaining each operation gestalt of this invention.

[0009] In drawing 1 (a), crevice 2A dented from the front face 5 in the base material 1 is prepared. Exposure 8A to crevice 2A of a base material 1 consists of a flat inclined plane 4 substantially prepared between the flat base 3, and a base 3 and a front face 5. By chemical vapor deposition, thick-film 6A is formed on the front face 5 of a base material, and exposure 8A. Thick-film 6A consists of parts for parts for base up part 6a and the side-face upper part 6b and 6c, and the surface upper part 6d and 6e.

[0010] In drawing 1 (b), exposure 8B to crevice 2B of a base material 1 consists of an inclined plane 7 substantially prepared between the flat base 3, and a base 3 and a front face 5. The inclined plane 7 is making the approximate circle arc. By chemical vapor deposition, thick-film 6B is formed on the front face 5 of a base material, and exposure 8B. Thick-film 6B consists of parts for parts for base up part 6a and the side-face upper part 6b and 6c, and the surface upper part 6d and 6e. In addition, the mask of the front face 5 is carried out, and a thick film can be prevented from generating in drawing 1 (a) and (b).

[0011] Cutting, grinding, or baking removes a base material 1, and the bulk object which consists of thick films 6A and 6B is acquired. By parts for base up part 6a and the side-face upper part 6b and 6c, and the surface upper part, under the present circumstances, 6d, It can be used as a bulk object, without separating 6e, and parts for the surface upper part 6d and 6e can be separated from parts for base up part 6a and the side-face upper part

6b and 6c, or parts for base up part 6a and the side-face upper part 6b and 6c can be separated, respectively, and the bulk object of another object can also be acquired.
[0012] In crevice 2A of a gestalt like drawing 1 (a), when a base material 1 is seen to a front face 5 in a perpendicular cross section, as for the include angle theta to the front face 5 of the side face 4 of exposure 8A, it is desirable that it is 30 degrees or more from a viewpoint of applying compressive stress to a thick film certainly, and it is still more desirable that it is 60 degrees or more. Moreover, it is desirable to make theta into 120 degrees or less from a viewpoint of preventing distortion and a crack, and considering as 100 degrees or less is still more desirable. [ / near the interface of a thick film and a base material ]
[0013] Furthermore, since there is an inclination for theta to collect on the corner of the base 3 of a crevice and a side face 4 at the time of chemical vapor growth in being large, and for material gas to produce a minute cavity, it is desirable to make theta into 110 degrees or less from a viewpoint of preventing such a cavity.
[0014] Also in crevice 2B of a gestalt like drawing 1 (b), when a base material 1 is seen to a front face 5 in a perpendicular cross section, about the optimum range of the include angle theta to the front face 5 of the inclined plane (side face) 7 of exposure 8B, the above-mentioned convention is applied. That is, it is thought that the compressive stress which joins a thick film receives control mainly with the magnitude of theta.
[0015] R shows radius of curvature when the inclined plane 7 is curving. In being small, the inclined plane 7 is curving [ R ] steeply, and in being large, the inclined plane 7 is curving [ R ] gently. If R becomes infinity, it will become the gestalt of drawing 1 (a).
[0016] And when a base material 1 is seen to a front face 5 in a perpendicular cross section, as for exposure 8B, it is desirable that the part with a radius of curvature of R= 0.5mm or more is included, and it is still more desirable that the part 3.0mm or more is included. Furthermore, it is desirable that the whole exposure 8B consists of a part with a radius of curvature of R= 0.5mm or more (3.0 moremm or more), and does not contain a less than (less than 3.0 moremm) 0.5mm part in this case. Radius of curvature R tends to produce defects of gas accumulation in a less than 0.5mm part at the time of chemical vapor growth, supply of fresh gas is checked locally, and there is an inclination which a cavity produces.
[0017] On the other hand, in drawing 1 (a), 90 to 120 ", when large in comparison, as theta mentioned above, in the corner of a base 3 and an inclined plane 4, it becomes easy to produce defects of gas accumulation. It is desirable to set R to 0.5mm or more from a viewpoint of preventing such defects of gas accumulation.
[0018] If the thickness of a thick film is the thickness which can form membranes by chemical vapor deposition, there will be especially no upper limit.
[0019] Although especially an upper limit does not have the maximum width W of a crevice, if the maximum width W of a crevice becomes too much large, it will become easy to generate a crack in a thick film in the base of the crevice again. In this case, it is desirable to set the maximum width W of a crevice to 500mm or less. However, when becoming easy to generate a crack in the thick film with which the maximum width W of a crevice was formed on the exposure to the crevice of a base material since it was large, the second crevice can be further formed in the base of the crevice.
[0020] Depth D of a crevice can be suitably set up according to the configuration of the bulk object made into the purpose. However, it is desirable to set D to 1mm or more from

a viewpoint of the operation effectiveness by this invention. Moreover, it is desirable to set D to 10mm or less from a viewpoint of preventing the nonuniformity of the thickness of the thick film on an exposure.

[0021] As ceramics which constitutes a bulk object, silicon carbide, boron carbide, titanium carbide, silicon nitride, alumimium nitride, boron nitride, a silica, an alumina, a zirconia, a titania, lanthanum chromite, lanthanum KOBARU tightness, and a lanthanum comics night are desirable, and silicon carbide is the most desirable.

[0022] Especially preferably, the purity of the ceramics in a thick film is 99.9999% or more, and relative density is seen to 0.1% of order, and is the same completeness precise object as theoretical density.

[0023] Although especially the quality of the material of a base material is not limited, especially its following are desirable.

(1) The sintered compact which uses silicon carbide as a principal component. For example, the sintered compact whose relative density the presentation ratio of (a) silicon carbide is 90% or more, and is 90% or more. (b) The porosity sintered compact whose relative density the presentation ratio of silicon carbide is 90% or more, and is 56% - 90%.

(2) The mixed sintered compact of silicon carbide and metal silicon.

(3) Insulating ceramics, such as silicon nitride and alumimium nitride.

(4) Graphite.

[0024] In itself [ chemical-vapor-deposition ], it can usually carry out by law. However, this invention is especially suitable in the field where membrane formation temperature is high in comparison, i.e., the field where a membrane formation rate is high in comparison. Especially in the field where membrane formation temperature is high in comparison, i.e., the field where a membrane formation rate is high in comparison, it is because it is easy to generate tensile stress in the front-face side of a thick film.

[0025] Since such temperature conditions change according to the class of ceramics which constitutes a thick film, they are difficult for becoming common as a numeric value. However, generally, when the membrane formation thickness per hour is 0.08mm or more, especially this invention is suitable.

[0026] Since it described above when the thick film of silicon carbide was formed, this invention is suitable especially when membrane formation temperature is 1370 to 1500 degree C.

[0027] The bulk object of the ceramics manufactured by this invention is applicable to various kinds of products. As such a product, the combustor for gas turbines, a stationary blade, a bucket, a heat exchanger, and combustion gas path components can be illustrated. Moreover, it is applicable also to an electromagnetic wave transparency object. In this, the dome for generating the tube for generating an electromagnetic wave transparency aperture, RF electrode equipment, and the high frequency plasma and the high frequency plasma can be illustrated. Moreover, the bulk object manufactured by this invention can be used as a base material of the susceptor for installing a semi-conductor wafer. As such a susceptor, a ceramic electrostatic chuck, a ceramic heater, and a RF arrangement of electrode can be illustrated. In addition, it can be used as a base material for each equipments for semi-conductor manufacture, such as a lift pin for supporting a dummy wafer, a shadow ring, and a semi-conductor wafer, and a shower plate.

## EXAMPLE

[Example] ((A) Experiment) According to said approach explained referring to drawing 1 (a), the bulk object which consists of silicon carbide was acquired. The silicon carbide film was formed in the front face of the graphite base material 1 by chemical vapor deposition. The configuration of a base material was a monotonous configuration, the dimensions of the front face 5 of a base material and a tooth back (not shown) are 600mm long and 50mm wide, and thickness of a base material was set to 20mm. Five was ground with the**800 or more front faces [ of a base material ] grinding stone, and the center line average surface roughness Ra was set to less than 3 micrometers. Crevice 2A was formed in the front-face 5 side of a base material. The flat-surface configuration of crevice 2A was made into the rectangle. The dimension of crevice 2A was changed as shown in drawing 1 . However, the crevice is not established in the front face of some base materials.

[0029] The base material 1 was held and installed in the chemical vapor growth furnace. Under the present circumstances, the base material was installed so that the front face 5 and tooth back of a base material 1 might become parallel to the jet direction of reactant gas, namely, so that the side face (not shown) of the base material of a monotonous configuration might counter an exhaust nozzle.

[0030] Vacuum suction of the inside of a furnace was carried out, argon gas permuted and the temperature up was carried out to 1400 degrees C. Subsequently, an argon and hydrogen are used as carrier gas and it is SiCl4 as reactant gas. And CH4 It introduced. The ratio of Si to C was adjusted to Si/C=1.1-1.3 (rate of a volume ratio when converting into reference condition). Furnace internal pressure was adjusted to 100-300Torr. Membrane formation of 30 to 50 hours was performed, it cooled, and the thick film of the silicon carbide of three to 5 mm thickness was obtained. Each obtained thick film was cut, the cross section was ground, and the existence of a crack was observed with the optical microscope. A result is shown in Table 1.

[0031]

[Table 1]

| | 凹部の縦横長さ（mm） | 凹部の最大幅W（mm） | 凹部の深さD（mm） | θ（°） | クラック等の観察結果 |
|---|---|---|---|---|---|
| 実験A1 | なし | なし | なし | なし | クラック発生 |
| 実験A2 | 40 | 50 | 6 | 20 | クラック発生 |
| 実験A3 | 40 | 50 | 6 | 30 | クラックなし |
| 実験A4 | 40 | 500 | 10 | 20 | クラック発生 |
| 実験A5 | 40 | 500 | 10 | 90 | クラックなし |

[0032] In experiment A5, although the crack was not seen, the minute cavity had

produced it in the corner of the base of a crevice.
[0033] ((B) Experiment) The thick film of silicon carbide was produced like Experiment A. However, crevice 2B of the configuration shown in drawing 2 (b) was formed. The flat-surface configuration of crevice 2B was made into the square, and the dimension was changed as shown in Table 2. Membrane formation of 30 to 50 hours was performed, it cooled, and the thick film of the silicon carbide of three to 5 mm thickness was obtained. Each obtained thick film was cut, the cross section was ground, and the existence of the cavity in the corner of the base 3 of crevice 2B was observed with the optical microscope. A result is shown in Table 2.
[0034]
[Table 2]

| | 凹部の縦横長さ（mm） | 凹部の最大幅W（mm） | 凹部の深さD（mm） | θ（°） | 曲率半径R（mm） | 空洞の有無 |
|---|---|---|---|---|---|---|
| 実験B1 | 40 | 50 | 6 | 90 | 0.2 | 空洞あり |
| 実験B2 | 40 | 50 | 6 | 90 | 0.5 | 空洞なし |
| 実験B3 | 40 | 500 | 10 | 90 | 0.2 | 空洞あり |
| 実験B4 | 40 | 500 | 10 | 90 | 3.0 | 空洞なし |

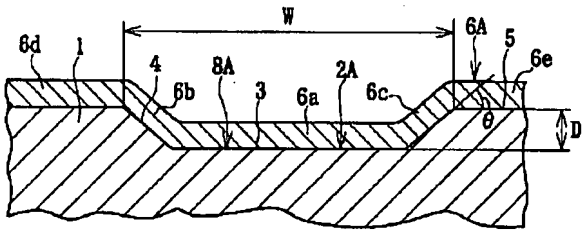
## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (a) and (b) are the typical sectional views for explaining the manufacture approach of this invention, respectively.
[Description of Notations]
1 Base Material 2A, 2B Crevice 3 Base 4 Seven Side Face 5 Front Face of Base Material 6A, 6B Thick Film 6a A Part for Base Upper Part 6B, 6C A Part for Side-Face Upper Part 6D, 6E A Part for Surface Upper Part
8A, 8B Exposure which faces the crevice of a base material D The depth of a crevice R radius of curvature W The maximum width of a crevice theta Tilt angle to the front face 5 of the side face of a crevice

## DRAWINGS

[Drawing 1]

(a)




(b)